§29. Numerical Simulation of Recovery Current for Magnetic Profile

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In order to study the properties of the composite conductor for LHD helical coil, the short samples have been used to measure the properties such as the recovery current and the minimum quench energy. However, the properties of short samples might be different from those of the actual coil. For the purpose of estimating the actual properties of the coil conductor, the simulation study has been performed especially for the magnetic profile effect.

The recovery currents, which were the largest current that shrank the stagnated area, were measured in the short sample experiment. Evaluating this experiment, the simulations were done in a following way: The initial temperature distribution was given to establish the normal stagnation.

Maddock model was used as the heat transfer model as indicated in Fig.1. In Fig. 1, Th was a fitting parameter to give the same recovery current of the experiments in the simulations, and 4.4K. The recovery currents have been calculated for the parameters of the magnetic field profile, and the wider profiles give the lower recovery currents. The calculation results were plotted in Fig. 2. The horizontal axis is the profile parameter and this is normalized by the experimental length. If the length of the conductor is 3 to 4 times longer than that of the experiment, we can obtain an actual recovery current.

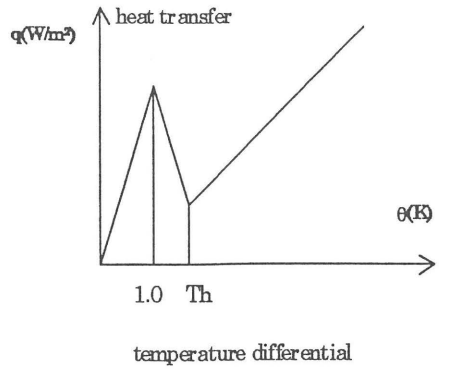

Fig 1: heat transfer model

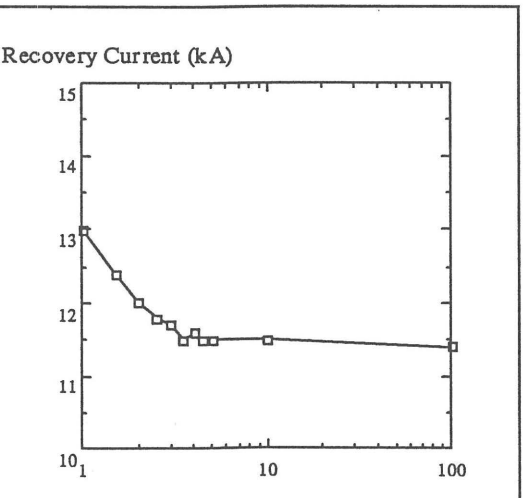

Fig 2: scale dependency